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FINAL TECHNICAL REPORT

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"Search for Correlated Large-Scale Structure in the Cosmic X-Ray and
Cosmic Microwave Backgrounds," S. P. Boughn, PI

January 18, 1993

The research funded by this grant was begun before the discovery of fluctuations in the microwave background by the COBE satellite mission. This resulted in a more specific question to be addressed by the current project: "Is it possible that the fluctuations seen by COBE are due to inverse Compton scattering from hot electrons in supercluster pancakes?" (see C. Hogan, *Ap. J.*, 1992). If this were the case, then the COBE maps would not be a picture of the fluctuations in the primordial plasma at the time of decoupling but would rather be due to conditions in the relatively local Universe. If the hot gas exists, it would also be a source of bremsstrahlung X-rays in the 2–20 KeV range, assuming a gas temperature of about 10^8 K range. In this case, one would expect the cosmic X-ray background to be anticorrelated with the cosmic microwave background because of the negative temperature signature of inverse Compton scattering below the peak of a blackbody spectrum. We searched for such an anticorrelation on angular scales of 10 degrees (the scale of the fluctuations of the microwave background) between a 19 GHz full sky map and the 2–60 KeV HEAO 1 A-2 full sky X-ray map. The lack of anticorrelations between these two maps allowed us to set an upper limit on the physical conditions in the hypothetical supercluster gas, i.e. a 90% confidence level limit of $n\beta/t^{1/2} < 0.1$, where n is the density of gas in units of $10^{-5.5} \text{ cm}^{-3}$; t is the temperature of the gas in units of 10^8 K; and β is a constant on the order of unity which depends on the detector bandpass. This constraint on " n " and " t " make it very unlikely that the fluctuations detected by COBE result from inverse Compton scattering occurring in local supercluster pancakes. This result has only recently been obtained and will be submitted for publication within a month.

During the period of the grant, Haverford undergraduate Tom Evans participated in the research and submitted a senior thesis related to this topic. Preliminary results of his work appear in the Proceedings of the Keck Northeast Astronomy Consortium Symposium (1991). Ruth Daly, Princeton, and Keith Jahoda, GSFC, are also collaborators in this research.

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